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AUTHOR Carrell, Patricia L.
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ABSTRACT

Although successful reading comprehension is described as the interaction of text-based processes and processes related to the reader's existing background knowledge or schemata, under different conditions readers show different patterns of text-based versus knowledge-based processing. Recent research suggests that students of English as a second language (ESL) rely on one or the other process for comprehension, excluding the other. One explanation touches on schema availability, schema activation, skill deficiencies, conceptions about reading in a second language, and individual differences in cognitive style. Research supports the idea that the absence of the content and formal schemata appropriate to a particular text can cause processing difficulties. When schema are available, the text may not contain enough lexical cues to activate them. A unidirectional reading style (text-biased or knowledge-biased) may also be brought out by two opposing skill deficiencies, of linguistic and reading skills. Students may also misunderstand the purpose of ESL reading and the processes expected of them, perhaps as a result of overemphasis on the decoding process, reading passages that are not relevant to readers' interests, and tests stressing literal content. Further research is also recommended on differences in ESL reading comprehension styles similar to other manifestations of cognitive style. (MSE)

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SOME CAUSES OF TEXT-BOUNDEDNESS AND SCHEMA INTERFERENCE IN ESL READING

by

Patricia L. Carrell

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Department of Linguistics
Southern Illinois University
Carbondale, Il. 62901
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SOME CAUSES OF TEXT-BOUNDEDNESS AND SCHEMA INTERFERENCE IN ESL READING

Patricia L. Carrell

Abstract

Although successful reading comprehension has been described as the interaction of text-based processes and processes related to the reader's existing background knowledge or schemata, knowledge-based processes (Anderson 1977, Rumelhart 1977), we also know that under different conditions different readers exhibit different patterns of resource allocation to text-based (bottom-up) versus knowledge-based (top-down) processing. Skilled readers constantly shift their mode of processing, accommodating to the demands of a particular text and a particular reading situation; less skilled readers tend to overrely on processes in one direction, producing deleterious effects on comprehension (Spiro 1978, 1979).

In recent research on ESL reading (Carrell 1983a, Carrell and Wallace 1983), it was found that ESL readers were not effectively utilizing knowledge-based processes (contextual information they were supplied with) to facilitate comprehension. They appeared to be engaged almost exclusively in text-based processing to the detriment of comprehension. By contrast, in other studies (Steffensen, Joag-dev, and Anderson 1979, Johnson 1981, Carrell 1981), some evidence was found of overreliance on top-down processes. What underlies such unidirectional biases in discourse processing in a second language?

This paper explores the underlying causes of such unidrectional biases in ESL reading comprehension---overreliance on text-based processes, and over-reliance on knowledge-based processes. An explanation is proposed in terms of (1) schema availability, (2) schema activation, (3) skill deficiencies, including linguistic and reading skills, (4) conceptions about reading in a second language, and (5) individual differences in cognitive style.

SOME CAUSES OF TEXT-BOUNDEDNESS AND SCHEMA INTERFERENCE IN ESL READING

Patricia L. Carrell

Introduction

Recent developments in the theory of knowledge representation, going under the general rubric of schema theory (Bartlett 1932, Anderson 1977, Adams & Collins 1979, Rumelhart & Ortony 1977, Rumelhart 1980) have had a pervasive influence on current thinking about text comprehension. Through an emphasis on the role of pre-existing knowledge structures in providing information left implicit in text, schema-theoretic approaches have made possible the fairly detailed modeling of many of the active, constructive processes necessary to comprehension (e.g., Schank & Abelson 1977). Within the schema-theoretic framework, text comprehension, or more specifically for our purposes today, reading comprehension, is characterized as involving an interaction of text-based processes and knowledge-based processes, the latter related to the reader's existing background knowledge or schemata (Adams & Collins 1979, Anderson 1977, Rumelhart 1977, Rumelhart & Ortony 1977, Rumelhart 1980). A recent paper by myself and Joan Eisterhold in the latest issue of the TESOL Quarterly describes how schema theory conceptualizes the interaction of text-based and knowledge-based processes, or, as they were called in that paper, bottom-up and top-down processing modes. Without going into all the detail and all of the examples presented in that article, which you may read for yourselves, but to insure that my comments today are as clear as possible, I will briefly review the schema-theoretic notions of the interaction of bottom-up or text-based processing, and top-down or knowledge-based processing.

> "According to schema theory, the process of interpretation is guided by the principle that every input is mapped against some existing schema and that all aspects of that schema must be compatible with the input

information. This principle results in two basic modes of information processing, called bottom-up and top-down processing. Bottom-up processing is evoked by the incoming data; the features of the data enter the system through the best-fitting, bottom-level schemata. Schemata are hierarchically organized, from most general at the top, to most specific at the bottom. As these bottom-level schemata converge into higher level, more general schemata, these too become activated. Bottom-up processing is, therefore, called data-driven. Top-down processing, on the other hand, occurs as the system makes general predictions based on higher-level, general schemata and then searches the input for information to fit into these partially satisfied, higher order schemata. Top-down processing is, therefore, called conceptually-driven.

An important aspect of top-down and bottom-up processing is that both should be occurring at all levels simultaneously (Rumelhart 1980). The data that are needed to instantiate, or fill out, the schemata become available through bottom-up processing; top-down processing facilitates their assimilation if they are anticipated by or consistent with the listener/reader's conceptual expectations. Bottom-up processing ensures that the listeners/readers will be sensitive to information that is novel or that does not fit their ongoing hypotheses about the content or structure of the text; top-down processing helps the listeners/readers to resolve ambiguities or to select between alternative possible interpretations of the incoming data." (Carrell & Eisterhold 1983:557)

In keeping with the theme of this colloquium---ESL reading as interaction with text---in this paper I would like to explore the bidirectionality of text-based and knowledge-based processing of text in ESL reading comprehension.

Specifically, I will discuss some factors which may interfere with efficient bidirectional text processing and cause overreliance on one or the other mode of processing, which may in turn result in comprehension problems. I will refer to overreliance on text-based or bottom-up processing as text-biased processing or text-boundedness, and overreliance on knowledge-based or top-down processing as knowledge-biased processing or schema interference.

In order to illustrate overreliance on text-based processing and knowledge-based processing, I shall discuss a sample text from Fillmore (1982). Imagine the reader who encounters the following mini-text:

The princess ate some jam.

The queen slapped her.

The princess began to cry.

The text-based processing of this text involves decoding the individual words and their lexical meanings, and decoding the syntactic structures of each sentence and their grammatical-functional meanings as subjects, direct objects, etc. Fillmore calls this level E-0 envisionment, E-0 level processing. If this text-based processing were the only kind of processing going on, one would understand from this text only that somebody who is a princess ate some jam, and someone who is a queen slaps a female being, and somebody who is a princess cries. If, however, in reading the three sentences, knowledge-based processing is successfully invoked, the reader would assume that she was dealing with a cohesive, coherent text, rather than three separate sentences. Fillmore calls this level E-1 of envisionment. So the reader might assume that the princess in sentences 1 and 3 and the her in sentence 2 all refer to the same person. If the reader engages in yet further knowledge-based processing, she might invoke a Royal Family schema and assume the queen in sentence 2 is the princess's mother. At a still higher level of knowledge-based processing,

Fillmore's level E-2 of envisionment, the reader might interpret the text in terms of her knowledge of human goals, institutions, and human nature. She might make sense of what is going on in the text by assuming that the queen's act of slapping the princess is related to the princess's having eaten the jam (e.g., as punishment), and assume the princess's tears are in response to the slap (e.g., showing pain, remorse, shame). So far, these knowledge-based assumptions about the text seem well-motivated by the text and general, conventional knowledge about human behavior. In fact, they seem to be the kinds of knowledge-based assumptions we feel the writer must have intended the reader to make in order to understand the text. However, the reader might do additional knowledge-based processing of the text (Fillmore's level E-3 envisionment) and fill in details not motivated by the text itself or by general conventional knowledge. The reader might inject her own personal experiences or assumptions about human behavior and assume, for example, that the queen was selfish and had wanted the jam herself, or that the jam was plum-flavored. If the reader engages in much of this latter type of knowledge-based processing, we have an overreliance on knowledge-based processing.

E-0	- text-based processing only
E-1 & E-2	- text-based processing and knowledge-based processing
E-3	- knowledge-based processing only

In some recent studies of ESL reading (Carrell 1983a, Carrell & Wallace 1983), it was found that ESL readers were not effectively utilizing knowledge-based processes, specifically they were not utilizing the contextual information they were supplied with, to facilitate comprehension. They appeared to be engaged almost exclusively in text-based processing to the detriment of comprehension. I will say more about one of these studies shortly.

By contrast, other studies of ESL reading have found what appears to be evidence of overreliance on or interference in top-down or knowledge-based processes. Here I'm referring to the studies by Peg Steffensen (Steffensen, Joag-dev, and Anderson 1979), Pat Johnson (1981), and myself (Carrell 1981) which have shown the effects of culturally-biased content schemata. What causes such unidirectional biases in text processing, especially in reading in a second language? No one can say for certain, including me. However, I shall hypothesize some causes for the breakdown of bidirectional processing and the overreliance on unidirectional processing in ESL reading. I will group and discuss these causes under the following headings:
(1) schema availability, (2) schema activation, (3) skill deficiencies, including deficiencies in reading skills, as well as linguistic deficiencies, (4) misconceptions about reading, specifically about reading in a second language and especially in a second language classroom where reading evaluation is involved, and (5) individual differences in cognitive styles. I shall take these topics in order, and I hope what I have to say about schema availability and activation will complement Peg Steffensen's and Pat Johnson's papers, and that what I have to say about skill deficiencies will comlement David Eskey's paper, and that what I say about conceptions and misconceptions of reading will complement Joanne Devine's paper. By identifying and discussing these five causes of overreliance on text-based or knowledge-based reading, I am not claiming that this list is exhaustive or that the causes are mutually exclusive.

Schema Availability

The most obvious cause of overreliance on the text in comprehension is the absence of relevant knowledge structures to utilize in top-down processing; if the schemata do not exist for the reader they cannot be used. However much the vocabulary and syntax of a highly technical or scientific text are simplified, it is unlikely that any reader (adult, child, native or non-native) will comprehend it without first acquiring the requisite background of scientific knowledge. (Isn't this why my psycholinguistic students say they really understand their textbook only after they've had the whole course? They understand the early chapters much better after they've gotten more background from the entire course. And how many of us can say that we really understood Chomsky's Aspects until after the second or third reading?)

In seeking to understand the role of schema availability in ESL reading comprehension, it is often useful to draw a distinction between formal schemata (background knowledge of the formal rhetorical organizational structure of the text) and content schemata (background knowledge of the content area of the text) (Carrell 1983b). In other words, one type of schema a reader needs to possess in order to comprehend a text is background knowledge about rhetorical organization, e.g., differences in the structure of fables, short stories, newspaper articles, poetry, and expository text types. The other type of schema a reader needs to possess is background knowledge about the content area of a text, e.g., information about physics, Greek mythology, Black American culture, or the political situation in Lebanon.

As Carrell and Eisterhold (1983) argue, one of the most obvious reasons a particular content schema may fail to exist for a reader is that the schema is culturally-specific. Studies by Peg Steffensen (Steffensen, Joag-dev, and Anderson 1979), Pat Johnson (1981), and myself (Carrell 1981) have all shown that implicit cultural content knowledge presupposed by a text and a reader's

own cultural background knowledge of content interact to make texts whose content is based on one's own culture easier to read and understand than syntactically and rhetorically equivalent texts based on a less familiar, distant culture.

Other research has shown general effects of content schemata on ESL reading comprehension. Pat Johnson's 1982 TESOL Quarterly paper has shown that a text on a familiar topic is better recalled by ESL readers than a similar text on an unfamiliar topic. Alderson and Urquhart (1983) have found a discipline-specific effect of familiar versus unfamiliar content background knowledge in measuring reading comprehension in English for Specific Purposes (ESP), English for Science and Technology.

Fewer studies have been done showing the effects of formal schemata in ESL reading. However, some of the studies done in the area of contrastive rhetoric (Ostler & Kaplan 1982) reveal the effects of formal schemata on both the comprehension and production of written text in a second language. In particular, Hinds' research (1983a, 1983b) shows the contrasting effects on different groups of readers of texts organized with a typical Japanese pattern and those organized with a typical American English pattern. A recent paper of mine (Carrell 1984) has shown the effects of different types of rhetorical organization of English expository prose on ESL readers of different native language backgrounds. The results in that study indicated that certain types of English rhetorical organization are more facilitative of recall for non-native readers in general, but there are differences among the texts for the different native languagea groups targeted in the study: Spanish, Arabic, and Oriental (Korean and Chinese). It is speculated in that paper---and I admit it is only speculation at this point---that one of the causes of these differences may be the absence of some of the different formal schemata among the different groups of ESL readers.

Thus, in summary for this section on schema availability, a number of empirical studies have shown that the absence of the content and formal schemata appropriate to a particular text can result in processing difficulties with that text. If ESL readers are not able to engage successfully in an appropriate degree of knowledge-based processing because they lack the appropriate content and/or formal schemata, they will resort to other strategies. Either they will overrely on text-based processes, and try to construct the meaning totally from the textual input (a virtual impossibility, because no text contains all the information necessary for its comprehension), or they will substitute the closest schema they possess and will try to relate the incoming textual information to that schema, resulting in schema interference. In either case, comprehension and recall suffer.

Schema Activation

Of course, schema availability alone is not a sufficient condition for adequate comprehension. Relevant schemata must be activated (Carrell and Esiterhold 1983), although the processes by which schemata are evoked are not well understood.

The Carrell (1983a) and Carrell and Wallace (1983) studies previously mentioned showed that ESL reading comprehension may be affected not because the ESL readers lack the appropriate schema, but because they fail to activate the appropriate schema. In one part of the Carrell and Wallace (1983) study, advanced ESL readers were faced with a text about a familiar topic ("Brushing Your Teeth"), which did not contain sufficient textual (i.e., lexical) cues to signal the appropriate schema to be activated. (I've called such texts "opaque.") In post-experimental debriefing of subjects, prior familiarity with the text topic was determined to be 4.9 on a 5.0 scale; thus, we are certain that subjects possessed the appropriate schema for this text. However, for the

advanced ESL readers of this text, there were no differences in their reading recall performance whether they were told the topic prior to reading or not (i.e., context or no context). See Figure 1.

Insert Figure 1 about here

That is, the vast majority of the ESL readers possessed the appropriate schema, and those in the context condition were even told which schema to activate. Yet, because the text itself failed to signal the appropriate schema, not only did those without context engage in text-based processing---the only possibility for that condition---but even those who were given the context prior to reading failed to access it to make the appropriate bidirectional linkages between the text and the context.[1]

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[1]Bransford, Stein and Vye (1982) describe an interesting training/intervention technique they've used successfully to show fifth grade native readers of English that knowledge activation can be a significant help in reading comprehension and in later recall from memory.

Skill Deficiencies

Two different but potentially related types of skill deficiencies may cause the inefficient interaction of text-based and knowledge-based processing in ESL reading: (1) linguistic deficiencies, and (2) reading skill deficiencies. The important role of language competence in English for successful ESL reading is too obvious to warrant belabored discussion here. Obviously, text-based processing cannot take place at all without appropriate skill levels in decoding the syntactic structures, and possibly more importantly, the content vocabulary of a text. More significantly in this regard, Clarke's (1979) research on native Spanish and ESL reading showed that second language proficiency may limit the transference of good L1 reading skills to reading in the second language. Thus, we must recognize the crucial role of English language skills in text-based processing. Without these skills, efficient interaction between text-based and knowledge-based processing cannot occur. However, as Hudson's (1982) research showed, efficient knowledge-based processing can often compensate for lower proficiency levels in language.

Given the role of linguistic deficiencies, how might reading skills in the second language and the way these reading skills are manifested in a reading comprehension style affect efficient bidirectional interaction with text? Spiro (1978) argues for a two-level approach to this question. The first level concerns the various component skills of reading comprehension and deficiencies among these component skills; the second level concerns how reading skill deficiencies manifest themselves in a reading comprehension "style." Cf. Figure 2.

Insert Figure 2 about here

Spiro argues that there is no determinate effect of the first level on the second; that is, different skill deficiencies may result in the same comprehension style, or one skill deficiency may result in differing comprehension styles. At the first level, reading problems may involve skills that are either predominantly text-based (e.g., decoding) or knowledge-based (e.g., pragmatic inferencing). Spiro reasons that two options are open to readers confronted with a skill problem of one of these two types: they may perservere in the problem area (with detrimental effects on the other process), or they may escape from the problem by shifting processing resources in an effort to compensate for the problem. For example, consider readers who are laborious, effortful decoders. They may perservere with their decoding efforts. However, given the limitations on information processing capacity and short term memory, this behavior soon produces a log-jam in the system---the reader attempts to store too many separate pieces of information without any higher-order relationship among them. In this style, higher-order, knowledge-based processes are neglected. On the other hand, readers who are effortful decoders may seek (not necessarily consciously) to avoid the unpleasant decoding task. One way to do that would be to rely on prior knowledge to infer or guess what is likely to be in the text rather than actually sampling or processing much of the text. In this style, text-based processing is neglected in favor of wild guessing about the text's content. Thus, the same skill deficiency (effortful decoding) may lead to either one of two totally different comprehension styles---text-biased or knowledge biased---depending on what the reader does in either perservering in the problem area or trying to escape from it. What this means is that the manifestation of a unidirectional reading comprehension style (text-biased or knowledge-biased) may be caused by two diametrically opposite reading skill deficiencies. The manifestation does not equal the cause.

Conceptions about Reading

Some of the work with native English-speaking children's reading, especially in classroom and evaluative settings, suggests that children seem to think that knowledge-based processing is not an appropriate activity in reading (Fillmore 1982, Spiro 1979). They fail to correctly answer questions about text that require extra-textual knowledge. When informally interrogated, they are perfectly able to answer the same questions. If they are asked why they did not utilize the same knowledge to answer correctly after reading, they respond with remarks indicating they thought they were not supposed to. They suffer from what has been called a "meaning is in the text" fallacy (Spiro 1979). It is also interesting to note that for some children, this fallacy seems to apply only to their reading for school.

It is purely conjecture on my part, for I know of no research on this question, but I wonder whether many of our ESL readers suffer from the same misconceptions about reading in ESL, especially in classroom settings where reading is often done for the teacher's purposes and not the students', and where reading comprehension is usually tested by question-answering? And, if many ESL readers do misconceive ESL reading as primarily a bottom-up process, what causes such misconceptions? Possible candidates include over-emphasis on decoding skills, and on the code in general, especially in early language and reading instruction; reading passages that are insular and lacking in relevance to existing knowledge and reader interests; and tests of reading that stress literal text content rather than its integration with related prior knowledge.

Cognitive Style

For lack of a better label, under the rubric of cognitive style I shall briefly mention one other possible cause of unidirectional processing. For some who under-utilize prior knowledge in understanding text, the problem may transcend reading. It may be a matter of cognitive style. Their reading style may be part of a general cognitive style of processing any incoming information, regardless of the type of information or its modality of transmission. Text is an external stimulus with a structure; interactive reading requires that relevant internal knowledge structures be superimposed on the text. Those who are overly text-bound in reading situations may tend to be stimulus-bound in general. Spiro (1978, Spiro & Tirre 1979) has studied the relationship between cognitive styles and reading comprehension for native English readers, using an embedded figures test. In an embedded figures test, a memorized geometric shape (an internal structure) must be located within a complex line and shading configuration in the visual field (an external stimulus structure). Spiro claims to have shown that those who have difficulty fitting the memorized internal structure onto the external stimulus structure in an embedded figures test also under-utilize internal knowledge structures in reading comprehension (Spiro 1978, Spiro & Tirre 1979).

Kimmel and MacGinitie (1984) have identified a reading strategy they call "perseverative text processing", wherein readers make an interpretation prematurely, based on only an initial sampling of the text and neglect to revise it in line with further information. They fail to reevaluate their initial hypothesis. Such readers experience great difficulty with inductively-organized material (main idea last). Based on their reading rates, however, it does not seem that these readers are merely reading only the first part of the text and failing to sample the rest of the text. They are also able to recall as many words as non-perseverative readers, but their recalls show they

have missed the main idea. They also exhibit this behavior on oral language comprehension tasks. Kimmel & MacGinitie have speculated that this behavior may be related to a more general construct underlying differences in the evaluation of hypotheses, namely an impulsivity-reflection dimension (Kagan 1965). We may be encountering the same types of individual differences in ESL reading comprehension styles. We won't know for sure, however, until the necessary empirical research is carried out.

Conclusion

What I have tried to do in this paper is suggest five different kinds of causes for overreliance on text-based or knowledge-based processing in ESL reading. Some of these have been more or less securely grounded in both theory and empirical research; others have been based on conjecture and supposition from schema theory and have yet to be empirically studied.

As researchers and educators it is important that we be aware not only that there are different maladaptive styles of reading comprehension---text-biased and knowledge-biased---but it is even more important that we be aware of the causes of these styles. If the same reading comprehension style---text-biased or knowledge-biased---can be attributed to a multiplicity of causes across individuals (bearing in mind that the extent to which causes co-occur for individuals has not yet been determined), then how we approach instruction should most logically be determined by the cause and not by its manifestation. As in some aspects of health care, this would be on time where we would need to treat the underlying causes, not the overt symptoms. What is likely to help an ESL reader with a text-bias that results from insufficient background knowledge (schema unavailability) will probably be different from what will help other readers with similar text-biases which result from a mis-conceptions about ESL reading, or from a decoding problem, or from cognitive style biases.

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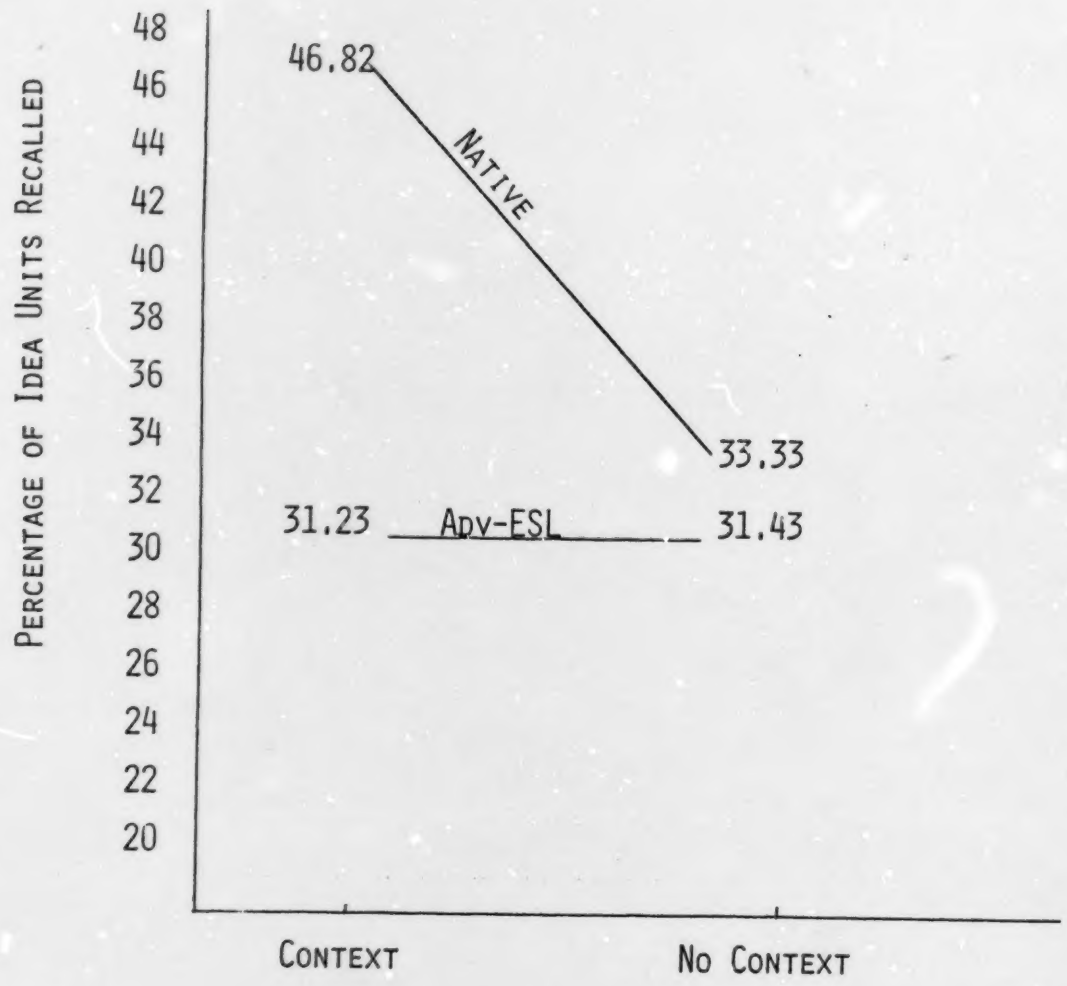
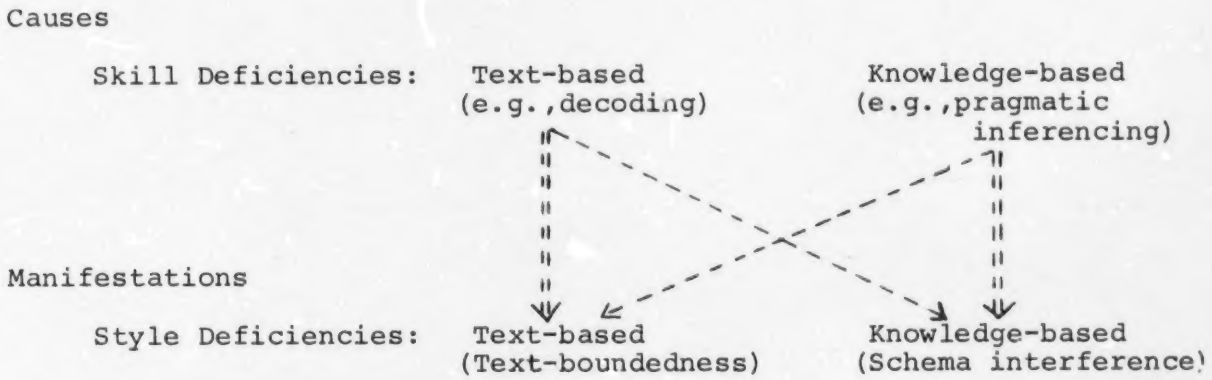


FIGURE 1.
FAMILIAR BUT OPAQUE TEXTS
CONTEXT AND NO CONTEXT
NATIVE AND ADVANCED-ESL READERS
(CARRELL AND WALLACE 1983)



=====⇒ = Perseverate

-----→ = Opt out

Figure 2

Reading Skill and Reading Style Deficiencies